



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/603,729	06/24/2003	Katsumi Yamamoto	39611-8015US	3361

62294 7590 09/22/2006

PERKINS COIE LLP  
P.O. BOX 1247 PATENT-SEA  
SEATTLE, WA 98111-1247

EXAMINER
----------

MADDEN, GREGORY VINCENT

ART UNIT	PAPER NUMBER
----------	--------------

2622

DATE MAILED: 09/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/603,729	YAMAMOTO, KATSUMI	
	Examiner	Art Unit	
	Gregory V. Madden	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 24 June 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 June 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Specification*

The disclosure is objected to because of the following informalities: The final two lines of Para. [0004] recite "In sum, it is desired that the micro-lenses be as close to each other as possible with touching." Based on the remainder of the specification, it is believed that the above line should read –In sum, it is desired that the micro-lenses be as close to each other as possible without touching--.

Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**Claims 5 and 12** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 5 and 12, the phrase "on the order of" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

For purposes of examination, however, the claims will be interpreted to read "...wherein said raised ridge structure has a height of 0.2 microns" and examined as such.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**Claims 1, 6, 8, 13, 15, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Tan et al. (U.S. Pat. 6,043,481).**

First, regarding **claim 1**, the Tan reference teaches an image sensor comprising a plurality of pixels formed in a semiconductor substrate (substrate 12), each pixel including a light sensitive element (optoelectronic elements 14), a micro-lens (micro-lens element 18) over each of the light sensitive elements, and a raised ridge structure (ridge elements 19) surrounding each of the micro-lenses. Please refer to Figs. 4 and 9b, and Col. 3, Lines 35 – Col. 4, Lines 10.

Considering **claim 6**, the limitations of claim 1 are taught above, and Tan further discloses that the raised ridge structure (19) is formed from the same material (i.e. the raised ridge structure is part of light transmissive layer member 16) that underlies the micro-lenses (18). See Fig. 4 and Col. 3, Lines 37-50.

In regard to **claim 8**, as is similarly disclosed above with respect to claim 1, the Tan reference teaches pixel of an image sensor comprising a light sensitive element (optoelectronic elements 14) formed in a semiconductor substrate (substrate 12), a micro-lens (micro-lens element 18) over the light sensitive element, and a raised ridge structure (ridge elements 19) surrounding the micro-lens. Please refer to Figs. 4 and 9b, and Col. 3, Lines 35 – Col. 4, Lines 10.

As for **claim 13**, the Tan reference teaches the limitations of claim 8 above, and Tan further discloses that the raised ridge structure (19) is formed from the same material (i.e. the raised ridge

Art Unit: 2622

structure is part of light transmissive layer member 16) that underlies the micro-lenses (18). See Fig. 4 and Col. 3, Lines 37-50.

Next, regarding **claim 15**, Fig. 9B and Col. 5, Lines 20-38 of the Tan reference teaches a method of forming a pixel of an image sensor comprising forming a light sensitive element (14) in a semiconductor substrate (12), forming a top planarizing layer (16) over the light sensitive element, forming a raised ridge structure (19) over the top planarizing layer, the raised ridge structure encompassing the light sensitive element, and forming a micro-lens (18) within the interior of the raised ridge structure and over the light sensitive element.

In regard to **claim 16**, the limitations of claim 15 are taught above, and Tan further discloses that the raised ridge structure (19) is formed in the top planarizing layer (16). Please refer to Figs. 4 and 9B, and Col. 3, Lines 41-45.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 2, 3, 9, 10, 17, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tan et al. (U.S. Pat. 6,043,481) in view of Assadi et al. (U.S. Pat. 6,166,369).**

Next, considering **claim 2**, the Tan reference teaches the limitations above, and while Tan does teach that a raised ridge structure (19) is located around the periphery of each micro-lens (18), Tan does not specifically disclose that the raised ridge structure is circular. However, the Assadi reference does teach a raised ridge structure (reflective surfaces 12) that surrounds each micro-lens and circularly

Art Unit: 2622

arranged around each photosensitive device (20) (See Col. 2, Lines 26-48 and Fig. 3). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have incorporated the circular ridge structure of Assadi with the ridge structure of Tan. One would have been motivated to do so because by using raised ridges that are circularly arranged around each micro-lens in the micro-lens array, the micro-lenses can be more closely packed together than if the raised ridges were quadrilaterally arranged, and thus the “fill factor” of light reaching the light sensitive elements can be greatly increased.

As for **claim 3**, again the limitations of claim 1 are taught above, but the Tan reference does not teach that the raised ridge structure has a triangular cross section. However, as is illustrated in Fig. 3 and disclosed in Col. 2, Lines 5-8, the Assadi reference teaches that the raised ridge structure (12) does have a triangular cross-section.

In regard to **claim 9**, the Tan reference teaches the limitations of claim 8 above, and while Tan does teach that a raised ridge structure (19) is located around the periphery of each micro-lens (18), Tan does not specifically disclose that the raised ridge structure is circular. However, the Assadi reference does teach a raised ridge structure (reflective surfaces 12) that surrounds each micro-lens and circularly arranged around each photosensitive device (20) (See Col. 2, Lines 26-48 and Fig. 3).

Regarding **claim 10**, again the limitations of claim 8 are taught above, but the Tan reference does not teach that the raised ridge structure has a triangular cross section. However, as is illustrated in Fig. 3 and disclosed in Col. 2, Lines 5-8, the Assadi reference teaches that the raised ridge structure (12) does have a triangular cross-section.

Next, considering **claim 17**, the Tan reference is shown to disclose the limitations of claim 15 above, but the Tan reference does not teach that the raised ridge structure has a triangular cross section. However, as is illustrated in Fig. 3 and disclosed in Col. 2, Lines 5-8, the Assadi reference teaches that the raised ridge structure (12) does have a triangular cross-section.

Art Unit: 2622

As for **claim 18**, again the limitations of claim 15 are taught above, but Tan does not specifically teach that the raised ridge structure is a closed shape. However, as is illustrated in Fig. 2 and taught in Col. 2, Lines 30-34, the Assadi reference discloses that the raised ridge structure is a closed shape (e.g. a circle or orthogonal pattern).

**Claims 4 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tan et al. (U.S. Pat. 6,043,481) in view of Applicant's admitted prior art.**

In regard to **claims 4 and 11**, the limitations of claims 1 and 8 are respectively taught above, but Tan does not specifically disclose that the micro-lenses are formed from polymethylmethacrylate or polyglycidylmethacrylate. However, noting Para. [0025] of the Applicant's current specification, the Applicant discloses that the use of acrylics such as polymethylmethacrylate or polyglycidylmethacrylate is common in forming micro-lenses. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have formed the micro-lenses of Tan using polymethylmethacrylate or polyglycidylmethacrylate. One would have been motivated to do so because the use of common materials reduces manufacturing costs and the need for additional specialized manufacturing equipment.

**Claims 5, 7, 12, 14, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tan et al. (U.S. Pat. 6,043,481) in view of Nakai (U.S. Pat. 5,396,090).**

Next, considering **claim 5**, the limitations of claim 1 are taught above by Tan, but the Tan reference fails to specifically disclose that the raised ridge structures have a height of 0.2 microns. However, the Nakai reference teaches an image sensor having a plurality of micro-lenses (66) surrounded by a raised ridge structure (partition wall 51), wherein the partition wall 51 can have a height of 0.2 microns, as taught in Figs. 1 and 5, and Col. 4, Line 46 – Col. 5, Line 50. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have incorporated the raised ridge

Art Unit: 2622

structure having a height of 0.2 microns, as taught by Nakai, with the raised ridge structure of Tan. One would have been motivated to do so because by limiting the height of the raised ridge structure, the dimensions of the image sensor can remain small, therefore allowing for use in compact imaging devices.

As for **claim 7**, again the limitations of claim 1 are taught above, but the Tan reference does not disclose the use of a color filter layer between the micro-lenses and the light sensitive elements.

However, the Nakai reference teaches the use of a color filter layer in the image sensor in Col. 6, Lines 28-31.

Regarding **claim 12**, the Tan reference teaches the limitations of claim 8, but Tan fails to specifically disclose that the raised ridge structures have a height of 0.2 microns. However, the Nakai reference teaches an image sensor having a plurality of micro-lenses (66) surrounded by a raised ridge structure (partition wall 51), wherein the partition wall 51 can have a height of 0.2 microns, as taught in Figs. 1 and 5, and Col. 4, Line 46 – Col. 5, Line 50.

In regard to **claim 14**, again the limitations of claim 8 are taught above, but the Tan reference does not disclose the use of a color filter layer between the micro-lenses and the light sensitive elements. However, the Nakai reference teaches the use of a color filter layer in the image sensor in Col. 6, Lines 28-31.

Finally, considering **claim 19**, Tan teaches the limitations of claim 15, but the method of Tan fails to teach the use of a color filter layer between the micro-lenses and the light sensitive elements. However, the Nakai reference teaches the use of a color filter layer in the image sensor in Col. 6, Lines 28-31.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Tanida et al. (U.S. Pat. 7,009,653)



Art Unit: 2622


Wang et al. (U.S. Pat. 5,952,645)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory V. Madden whose telephone number is 571-272-8128. The examiner can normally be reached on Mon.-Fri. 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ngoc Yen Vu can be reached on 571-272-7320. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gregory Madden  
September 13, 2006

  
NGOC-YEN VU  
SUPERVISORY PATENT EXAMINER